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SPECIFICATION FOR MANUAL BLOWPIPES FOR WELDING AND CUTTING

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NEW DELHI 110002

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September 1975

Indian Standard
SPECIFICATION FOR MANUAL BLOWPIPES FOR WELDING AND CUTTING

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(*Continued on page* 18)

Indian Standard
SPECIFICATION FOR MANUAL BLOWPIPES FOR WELDING AND CUTTING

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 15 May 1975, after the draft finalized by the Welding General Sectional Committee had been approved by the Structural and Metals Division Council.

0.2 This standard is the third in the series of standards relating to gas welding and cutting equipment, and covers manual blowpipes for welding and cutting of metals.

0.3 This standard keeps in view the manufacturing and trade practices followed in the country in this field. Assistance has also been derived from the following publications:

Doc: ISO/TC 44/SC 8(Secr—94) 131 Manual blowpipes for welding and Cutting. International Organization for Standardization.

DIN 8543 Sheet—1 1965 Welding and cutting blowpipes (injector type). Deutscher Normenausschuss. Berlin.

0.4 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

1. SCOPE

1.1 This standard covers the operational and safety requirements, methods of sampling and testing of manual blowpipes for welding and cutting of metals.

1.2 This standard also covers the combined manual welding and cutting blowpipes. The general requirements for the flame cleaning and flame heating blowpipes are also covered.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions and those given in IS : 812-1957† shall apply.

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*Rules for rounding off numerical values (*revised*).

†Glossary of terms relating to welding and cutting of metals.

2.1 Backfire — The return of the flame into the blowpipe with a popping sound when the flame is either extinguished or re-ignited at the nozzle.

2.2 Sustained Backfire — The return of the flame into the blowpipe with continued burning within the neck or handle of the blowpipe. This is accompanied by the initial popping and a hissing sound from the continued burning of the gases within the blowpipe.

2.3 Flashback — The return of the flame through the blowpipe in the hoses and even the regulator.

2.4 Backflow — Flow of the gas with a higher pressure back into the gas hose having the lower pressure. This can be caused if the nozzle becomes blocked.

3. CLASSIFICATION

3.0 The various major parts of the manual welding and cutting blowpipes are given in Fig. 1 and 2. Details of the sketches are for illustration only.

3.1 Types of Blowpipe — This standard covers the following types of blowpipes:

a) *Welding Blowpipe with Welding Attachment only.*

b) *Combined Welding and Cutting Blowpipes* — In this type the welding attachment (*see* Fig. 1) can be removed from the blowpipe shank and replaced by a cutting attachment permitting manual metal cutting.

c) *Cutting Blowpipe* — This is illustrated in Fig. 2 and used for cutting of metals. The cutting tip or nozzle may be of one or more pieces.

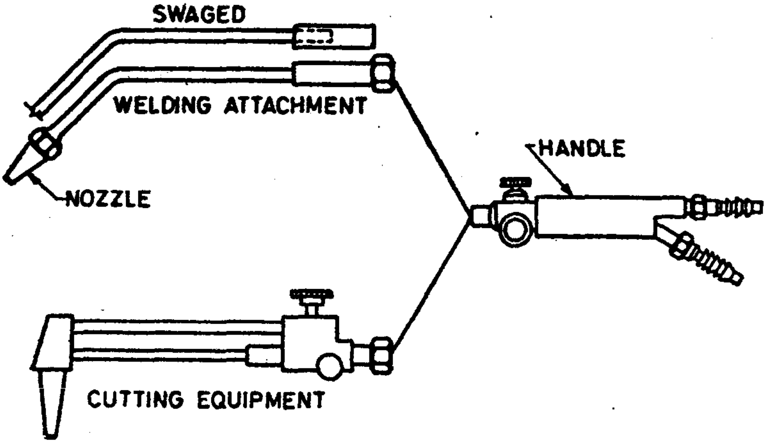

FIG. 1 COMBINED WELDING AND CUTTING BLOWPIPE

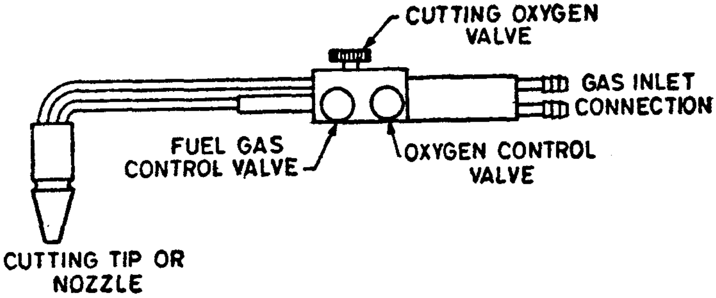

FIG. 2 CUTTING BLOWPIPE

3.2 The manual blowpipe may be further classified as follows on the basis of the gas pressures immediately before the point of mixing:

a) *High Pressure Blowpipe* — In this type the pressure of both the fuel gas and of the oxidizing gas measured immediately before the point of mixing is higher than the pressure of the gas mixture measured directly downstream between the mixer and the nozzle (*see* Fig. 3).

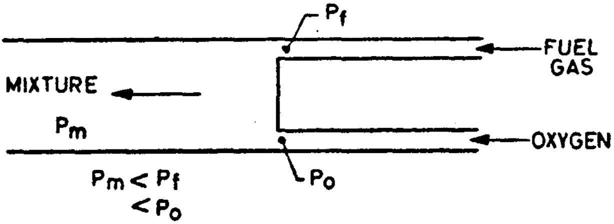

FIG. 3 GAS MIXING ARRANGEMENT IN HIGH PRESSURE BLOWPIPE

b) *Low Pressure Blowpipe* — In this type the pressure of one of the gases measured immediately before the point of mixing is lower than the pressure of the gas mixture measured directly downstream between the mixer and the nozzle (*see* Fig. 4).

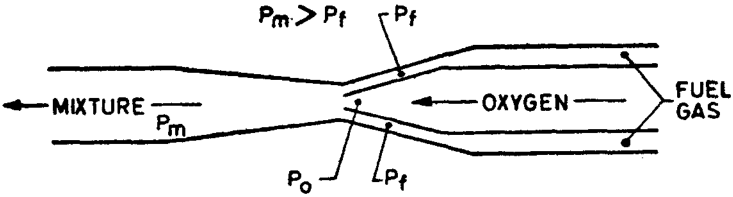

FIG. 4 GAS MIXING ARRANGEMENT IN LOW PRESSURE BLOWPIPE

Caution Note — While it is possible to use a blowpipe designed for 'low pressure' system with a 'high pressure' system, it is highly dangerous to use a blowpipe designed for 'high pressure' system with a 'low pressure' system.

3.3 The shank or handle of the blowpipe may be of one piece with integral gas control valves or may have separate valves mechanically attached to the shank.

3.4 The welding tip or nozzle may be a single piece swaged component or it may be screwed type for screwing on to the blowpipe neck (*see* Fig. 2).

4. GAS MIXING SYSTEM

4.0 In welding and cutting blowpipes, the fuel gas and oxidizing gas is mixed, and the gas mixture is burnt to produce a flame necessary for gas welding and oxygen metal cutting.

4.1 Injector Type Mixer — The fuel gas and the oxidizing gas is mixed by the action of the oxidizing gas which while discharging from the orifice of the injector reduces the pressure, thus entraining the fuel gas (*see* Fig. 4). Accordingly, when the valve in the fuel gas channel is closed while the oxidizing gas is discharging, the pressure in this channel is below the atmospheric pressure. If during this time the fuel gas hose connection nipple is exposed to the atmosphere, air will be entrained (*see* Fig. 4).

4.2 Mixer Without Injector Action — The fuel gas and the oxidizing gas is mixed when the latter discharging from the orifice meets the fuel gas which is discharging at nearly identical pressure. When the fuel gas channel is closed while oxidizing gas is being discharged, the pressure in this channel is higher than the atmospheric pressure. If during this time the fuel gas hose connection nipple is exposed to the atmosphere, oxidizing gas will be discharged (*see* Fig. 3).

4.3 Position of the Mixing System — The mixing system shall be either in the shank or between the shank and the nozzle or in the nozzle.

NOTE — In some types of oxy-fuel gas flame heating blowpipes which are basically similar in construction to the manual welding blowpipes, the fuel gas and the oxidizing gas may be made to mix outside the nozzle. Such a mixing is commonly known as post-mixing.

5. HOSE COUPLING NIPPLES

5.1 The nipples may be either integral with the shank or permanently fitted to the shank or detachable. The external profile of the nipple is left to the choice of the manufacturer but these shall be such as to ensure fitting of a hose nipple connection conforming to IS : 6016-1970*.

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*Specification for hose connection for welding and cutting equipment.

5.2 Adjacent to the oxygen inlet of blowpipe with permanently fitted hose coupling nipple or a detachable nipple, the oxygen inlet of the blowpipe shall be identified with the letter 'O' or using a 'blue' coloured identification ring, or disc or with suitable indelible paint.

5.3 Similarly the fuel gas inlet shall be marked with the following letters to indicate the particular gas for which the blowpipe has been designed:

Letter	*Fuel Gas*
A	Acetylene
C	Coal gas
H	Hydrogen
M	Methane
L	Liquefied petroleum gas

5.4 When the blowpipe is designed for use with more than one fuel gas, the fuel gas inlet shall be marked with a 'red' coloured identification ring, or disc or with suitable indelible paint.

6. MATERIAL

6.1 The material used for the blowpipes shall have adequate resistance to chemical and thermal attacks of the gases used and the environmental conditions.

6.2 The external surface shall be resistant to sparks and to other external influences.

6.3 Components in contact with oxygen shall be free from oil, grease and other contaminants.

6.4 Components in contact with acetylene (not the mixed gases) shall not contain copper over 70 percent.

6.5 Material subject to rusting shall not be used for parts in contact with oxygen.

7. VALVES

7.1 The valve spindles shall be captive.

7.2 The oxygen valve (body or the flow control knob) shall be identified by a 'blue' coloured ring or disc or with suitable indelible paint.

7.3 The fuel gas valve (body or the flow control knob) shall be identified by the letter indicating the fuel gas to be used (*see* **5.3**) and/or by a 'red' coloured identification ring or disc or with suitable indelible paint.

8. TEST REQUIREMENTS

8.0 The blowpipes shall conform to the following test requirements:

a) Initial approval tests,

b) Periodic check tests, and

c) Production control tests.

8.1 Initial approval tests shall comprise the following:

a) Pneumatic test (*see* **9.1**),

b) Cycle test for the gland packing of the gas control valves (*see* **9.2**),

c) Test for consumption of gases (*see* **9.4**),

d) Test for flame adjustment (*see* **9.5**),

e) Test for resistance to backfiring and sustained back firing due to overheating (*see* **9.6**), and

f) Test for resistance to sustained backfiring with partially closed orifice (*see* **9.7**).

8.2 The periodic check tests shall be carried out at least once a year, unless the design and/or material of construction is changed in which case the blowpipe shall be subjected to the initial approval tests (*see* **8.1**). The periodic check tests shall comprise the following:

a) Pneumatic test,

b) Test for flame setting, and

c) Test for resistance to backfiring and sustained backfiring due to overheating.

8.3 The test to be conducted for production control are left to the manufacturer's discretion, but pneumatic test and test for flame setting are obligatory. However, samples selected at random shall meet the requirements of the periodic check tests specified in **8.2**. In the event of a failure two more samples selected at random shall be subjected to the tests specified in **8.2** and both the samples shall pass the tests. Otherwise the equipment shall be deemed to have failed the test calling for initial approval test stipulated in **8.1**.

9. TESTS

9.1 Pneumatic Test — All gas passages, connections and valve seats shall be gas-tight internally and to atmosphere at a pressure of 1·5 times the maximum working pressure recommended by the manufacturer or 2·5 kgf/cm^2 whichever is maximum. The test procedure shall be as given in Appendix A.

NOTE — All blowpipes after manufacture shall be subjected to this test.

9.2 Cycle Test for the Gland Packing of the Gas Control Valves — The valve shall be fully open and then the spindle turned through 360°. This operation shall be repeated 1 000 times. After the cycle test the blowpipe shall be subjected to pneumatic test (*see* **9.1**) and there shall be no leakage through the gland.

9.3 Flame Setting — Initial flame adjustment shall be made at the set pressures and flow rates recommended by the manufacturer and flow trimmed to neutral.

NOTE — Variation shall be permitted up to ±10 percent in the pressures and flow rates as recommended by the manufacturer.

9.4 Test for Consumption of Gases — The manufacturer shall be able to specify the consumption of oxygen and fuel gas (at normal neutral flame) to be obtained from the nozzle size when the gases are supplied to the blowpipe as specified by the manufacturer.

9.4.1 Flow of fuel gas and oxidizing gas shall be related to the conditions of normal temperatures and pressure (27 ± 2°C and 1·0 kgf/cm^2 or 0·1 P_a).

NOTE — In case of cutting range this shall be expressed in terms of thickness in millimetres of mild steel that can be cut using a specific nozzle at the pressure and flow rate recommended by the manufacturer. The nozzle size may be designated by a number or the diameter of the cutting oxygen orifice expressed in millimetres. But the flow of cutting oxygen for a given nozzle shall be expressed in litres per hour and this information shall be made available by the manufacturer.

9.5 Test for Flame Adjustment

9.5.1 It shall be possible to adjust the flame continuously from carburizing to oxidizing around the nominated flow and pressures of the gases without any backfire or flashback or sustained backfire.

NOTE — Variation shall be permitted up to ±10 percent in the pressures and flow rates as recommended by the manufacturers.

9.5.2 *Turn-Down Ratio* — It shall be possible to reduce the size of a neutral flame from a nozzle set at the nominal conditions to that of the upper limit of next lower size subject to a maximum of 25 percent of flow rate taken from the manufacturer's complete range of nozzles without backfiring and sustained backfiring occurring.

9.5.3 *Stability of Flame in Wind* — It shall be possible to ignite the gases and maintain the flame in wind the direction of wind being perpendicular to the axis of the emergent gas stream of the orifice.

9.5.3.1 The test for stability of flame in wind involves lighting the flame of the blowpipe under test at the wind speed which is obtained by a suitable fan having a capacity of about 0·3 m^3/min. The fan shall be placed at about 300 mm away from the point of lighting the flame of blowpipe.

9.6 Test for Resistance to Backfiring and Sustained Backfiring due to Overheating — The blowpipe after lighting up and adjustment of the flame at the flow and pressures of gases recommended by the manufacturer is subjected to the test given in Appendix B. There shall be no backfire or sustained backfire in the mixer and/or injector when the nozzle is heated by the hemispherical cup (*see* Fig. 5) :

a) within 30 s after beginning the test, and

b) within 2 s of the initial backfire during the next 32 s. The total time taken by the test shall be 62 s.

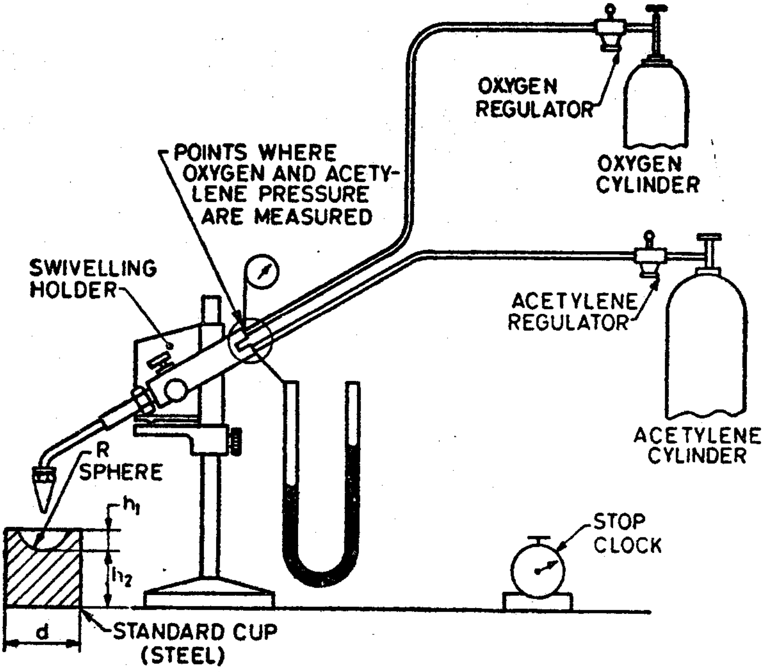


FIG. 5 TEST SET-UP (SCHEMATIC ARRANGEMENT) FOR BACKFIRING AND SUSTAINED BACKFIRING

9.7 Test for Resistance to Sustained Backfiring with Partially Closed Orifice — The blowpipe and nozzle shall be resistant to sustained backfiring when the orifice is partially closed. The method of conducting the test is given in Appendix C.

NOTE — This test is suitable for welding attachments and not for the cutting attachments or cutting blowpipes. A suitable test for cutting blowpipe will be added later.

9.7.1 The nozzle/blowpipe is acceptable when after 5 complete revolutions no sustained backfire occurs. Should a sustained backfire occur, stop the test, cool and clean blowpipe and nozzle. For acceptance, the test shall be repeated twice without sustained backfire with cooling between each test of 5 rotations.

9.7.2 *Prevention of Backflow* — It is possible to create a condition of backflow and the blowpipe or hose connection may be fitted with anti-backflow valve or device or such device so as to reduce the surge of backflow.

9.7.3 *Thermal Resistance* — No special test methods are stipulated to measure the thermal resistance. The backfire and sustained backfire tests given in **9.6** and Appendix C are sufficient to establish the suitability of the materials of construction used.

10. MARKING

10.1 The blowpipe shall be marked with the following information:

a) Name and/or registered trade-mark of the manufacturer,

b) Year or period of manufacture — Index marking shall be permitted if the manufacturer can satisfy that the year or period of manufacture can be traced from the index marking,

c) Fuel gas with which the blowpipe shall be used (*see* **5.3** and **5.4**),

d) Mixing system as indicated below:

    1) Mark 'LP' for low pressure blowpipes, and
    2) Mark 'HP' for high pressure blowpipes.

10.2 Nozzles for Welding Blowpipes — Nozzles shall be marked with a numbering system. This system should be such that from the data plate/sheet supplied by the manufacturer along with the blowpipe it shall be possible to get all the information required for operation for each of the nozzle (*see* **10.4**).

10.3 Nozzles for Cutting — The marking of the nozzle shall indicate the fuel gas to be used with the nozzle along with a numbering system. It shall be possible to refer to the data plate/sheet supplied by the manufacturer along with each cutting blowpipe and find out all the information required by the operator for each size of nozzle.

10.4 Data Plate/Sheet — Each blowpipe shall be supplied with a permanent type data plate/sheet which will provide operating data table for all the fuel gas recommended to be used with the blowpipe. For welding nozzle the operating data should include thickness of metal (mild steel) that can be welded and pressure recommended for oxygen and fuel gas for each size of the welding tip or nozzle. The data table for cutting should provide information on thickness in millimetres of mild steel that can be cut and the recommended pressures for fuel gas and oxygen for each nozzle.

Besides providing operating data table for all the fuel gas recommended to be used with the blowpipes, the data plates shall provide information in prominent red letters on components that are required to be changed while changing over from one fuel gas to another.

10.5 The blowpipe and the components may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

APPENDIX A

(*Clause* 9.1)

PNEUMATIC TESTS

A-0. The blowpipe shall be subjected to the following tests using oil free compressed air at 1·5 times the recommended pressure or 2·5 kgf/cm^2 whichever is maximum.

A-1. TESTS

Test 1 **Oxygen Passage to Atmosphere**

Test 2 **Fuel Gas Valve to Atmosphere** — The compressed air supply line is connected to the oxygen inlet connection. The fuel valve shall be kept closed and the nozzle jet orifice should be plugged and in case of cutting oxygen blowpipe, the cutting oxygen side shall be kept closed. After applying the test pressure, the blowpipe shall be held under water, no leak shall be observed at any of the valves and/or joints. In case of cutting blowpipe and combined welding and cutting blowpipe the test shall be repeated keeping the cutting oxygen valve open. Each test shall last two minutes.

Test 3 **Oxygen Valve in Seating** — The blowpipe as fitted for tests 1 and 2, the oxygen valve should be closed and the nozzle plug removed and when the nozzle is immersed in water, no leak shall be observed at the nozzle within two minutes.

Test 4 **Fuel Line to Atmosphere**

Test 5 **Oxygen Valve to Atmosphere** — The compressed air line is connected to the fuel and the supply line adjusted to 1·5 times the operational fuel gas pressure — for these tests oil-free compressed air may be used. Closing off the oxygen control valve, nozzle outlet and cutting oxygen passage side in case of the cutting blowpipe shall be closed, the fuel gas valve shall be fully opened and the blowpipe held under water — no leak at the valves, joints, etc, shall be observed within two minutes.

Test 6 **Fuel Gas Valve in Seating** — With the blowpipe fitted as under tests 4 and 5, the plug at the nozzle orifice shall be taken out and fuel control valve closed with supply line pressurized—the nozzle held under the water shall show no leak.

Test 7 **Test for Blowpipe Fitted with Injector Type Mixer Applicable to LP System Blowpipe** — The blowpipe shall be connected to oxygen/air supply system pressurized to the pressures and flows recommended by the manufacturer. The oxygen valve shall be opened followed by full opening of fuel valve. Positive injector/suction shall be obtained at the fuel gas connection.

Note — No definite suction valve is recommended as this depends very much on the design of the injector mix up which varies from manufacturer to manufacturer.

APPENDIX B

(*Clause* 9.6)

METHOD OF TESTING FOR RESISTANCE TO BACKFIRING AND SUSTAINED BACKFIRING AT HIGH TEMPERATURE

B-1. DETAILS OF TESTING

B-1.1 The blowpipe shall be fitted to fuel gas and oxygen supplies as shown in the schematic arrangement (Fig. 5).

B-1.2 The pressures of the fuel gas and oxygen regulators shall be adjusted to the recommendation of the manufacturer; the pressures shall be adjusted with control valve open.

B-1.3 The flame setting shall be done as given in **9.3** and shall be trimmed to a neutral flame.

B-1.4 The blowpipe shall then be affixed to the swivelling holder and swivelled into position, so that the flame points directly into the cup, the axis of the flame being identical to the axis of the cup. Cup sizes shall be in accordance with the Table 1 given below (*see* Fig. 5) :

TABLE 1 CUP SIZES

FUEL GAS CONSUMPTION l/h (1)	R mm (2)	h_1 mm (3)	d mm (4)	h_2 mm (5)
30 ± 5	10	6	100	75
40 ± 5	10	6	100	75
60 ± 5	10	12	100	75
80 ± 10	15	18	100	75
90 ± 10	15	18	100	75
140 ± 15	15	22	100	100
160 ± 15	20	24	100	100
200 ± 20	20	24	100	100
270 ± 25	20	26	100	100
315 ± 30	25	30	100	100
350 ± 35	25	30	100	100
500 ± 50	30	36	100	100
700 ± 70	35	42	150	100
800 ± 80	35	42	150	100
1 000 ± 100	35	44	150	100
1 250 ± 125	40	48	150	100
1 300 ± 130	40	48	150	100
1 600 ± 160	40	52	150	100
1 800 ± 180	45	54	150	100
2 000 ± 200	45	54	150	100
2 400 ± 240	50	60	150	100
2 500 ± 250	50	80	150	100

APPENDIX C

(*Clauses* 9.7 *and* 9.7.3)

SUSTAINED BACKFIRE TEST WITH PARTIALLY CLOSED ORIFICE

C-1. DETAILS OF TEST

C-1.1 The test assembly shall be as shown in Fig. 6. The dimensions of the copper test segment are given in Fig. 7.

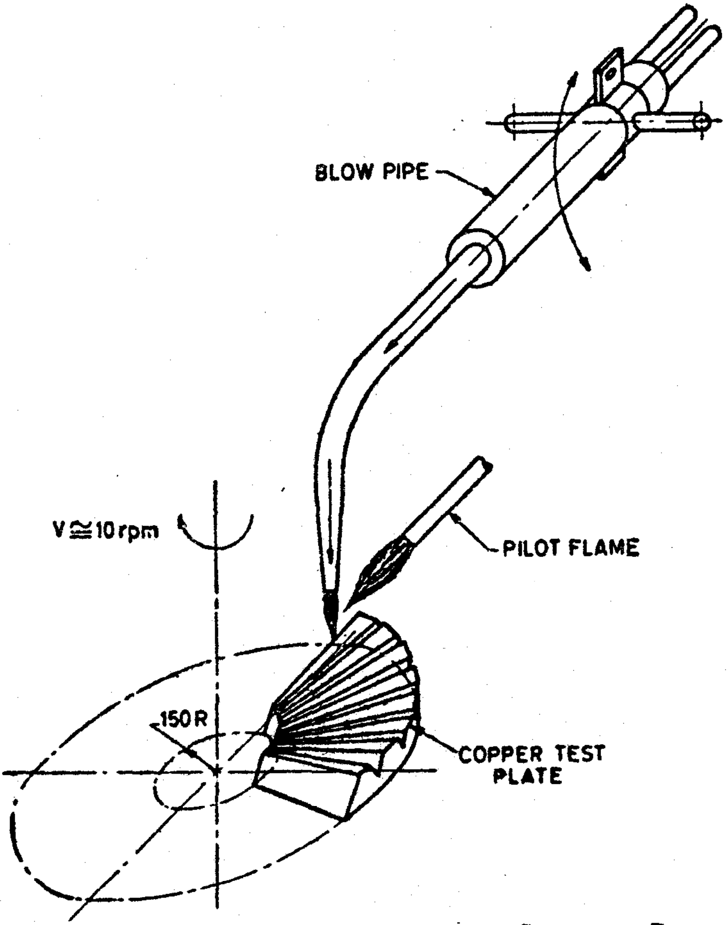
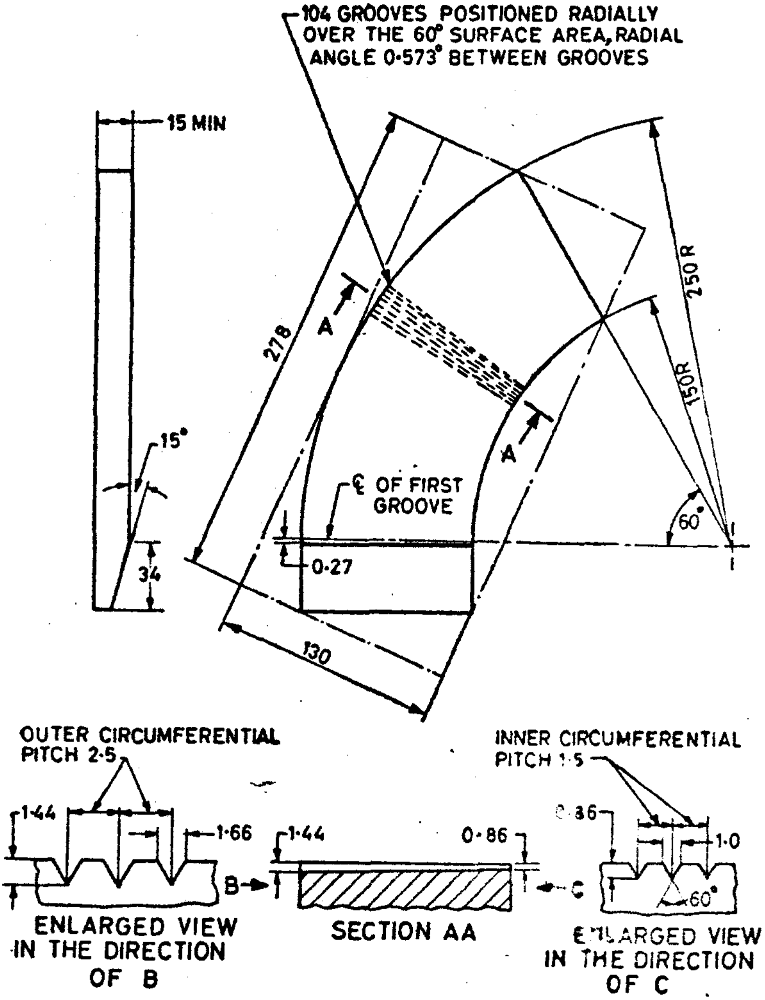


Fig. 6 Assembly for Testing Blowpipes to Sustained Backfire


104 GROOVES POSITIONED RADIALLY OVER THE 60° SURFACE AREA, RADIAL ANGLE 0·573° BETWEEN GROOVES
15 MIN
15°
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278
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℄ OF FIRST GROOVE
0·27
60°
130
OUTER CIRCUMFERENTIAL PITCH 2·5
1·44
1·66
B
ENLARGED VIEW IN THE DIRECTION OF B
1·44
0·86
SECTION AA
C
INNER CIRCUMFERENTIAL PITCH 1·5
0·86
1·0
60°
ENLARGED VIEW IN THE DIRECTION OF C

All dimensions in millimetres.

Fig. 7 Drawing for Machine Grooved Copper Test Segment

C-1.2 Test conditions shall be as follows (*see* Fig. 6):

Test radius from centre of rotation $\cong 100\ (1+0{\cdot}4 \log Q)$

where
Q = nominal flow of fuel gas in 1/h.

Vertical load between test segment and nozzle $F \cong 5$ N*.

Rotation speed of the copper test segment $V \cong 10$ rpm.

The orifice shall be perpendicular to and in contact with the test segment with a vertical load F acting on it.

C-2. FLAME SETTING CONDITION

C-2.1 The flame shall be neutral.

C-3. FLOW SETTING CONDITIONS

C-3.1 The test shall be conducted at nominated flow (*see* **9.4.1** and **9.5.2**) and at turned down flow conditions.

C-4. TEST PROCEDURE

C-4.1 The flame is ignited and stabilized for 30 s (adjustment to maintain a neutral flame is permissible). The copper test segment is then rotated at approximately 10 rev/min (no adjustment to maintain neutral flame required during rotation).

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*1 N = 0·102 kg.

(*Continued from page* 2)

Subcommittee for Welding Equipment and Accessories (Other than Power Source), SMDC 14 : 6

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INTERNATIONAL SYSTEM OF UNITS (SI UNITS)

Base Units

QUANTITY	UNIT	SYMBOL
Length	metre	m
Mass	kilogram	kg
Time	second	s
Electric current	ampere	A
Thermodynamic temperature	kelvin	K
Luminous intensity	candela	cd
Amount of substance	mole	mol

Supplementary Units

QUANTITY	UNIT	SYMBOL
Plane angle	radian	rad
Solid angle	steradian	sr

Derived Units

QUANTITY	UNIT	SYMBOL	DEFINITION
Force	newton	N	1 N = 1 kg.m/s^2
Energy	joule	J	1 J = 1 N.m
Power	watt	W	1 W = 1 J/s
Flux	weber	Wb	1 Wb = 1 V.s
Flux density	tesla	T	1 T = 1 Wb/m^2
Frequency	hertz	Hz	1 Hz = 1 c/s (s^{-1})
Electric conductance	siemens	S	1 S = 1 A/V
Electromotive force	volt	V	1 V = 1 W/A
Pressure, stress	pascal	Pa	1 Pa = 1 N/m^2

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